JP Kokai H9-45753

[Title of the Invention]

OBJECT SUPPORTING DEVICE

[Abstract]

[Object] To prolong the life of an object supporting device and by preventing wear of a supporting face because of mutual sliding between a wafer and the face, to prevent deterioration of the flatness precision of the supporting face and also to prevent bad effects on a semiconductor wafer and occurrence of disconnection and short circuit in the case of transferring a circuit to the wafer and defective resolution at the time of exposure by preventing dust adhesion to the supporting face and to prevent defective resolution by lowering the reflection of light at the time of exposure of a glass substrate.

[Solving Means] In an object supporting device having a supporting face made of a ceramic for holding a wafer such as a semiconductor wafer, a glass substrate for LCD or the like, the supporting face is coated with an amorphous hard carbon film.

[Claims]

1. An object supporting device having a supporting face made of a ceramic on which an object is supported by suction or mounting, wherein the above-mentioned supporting face is covered with an amorphous hard carbon film.

2. The object supporting device according to claim 1, wherein the film thickness of the above-mentioned amorphous hard carbon film is within a range from 0.2 to 10 μm.

[Detailed Description of the Invention]

[0001]

[Technical Field Pertinent to the Invention]

The present invention relates to an object supporting device suitable to be used for transporting or fixing an object, e. g., a wafer such as a semiconductor wafer and a glass substrate for LCD, a magnetic disk substrate, electronic components and the like.

[0002]

[Prior Art]

Conventionally, various object supporting devices have been used for transporting respective objects in the manufacturing process of a semiconductor integrated circuit, a LCD substrate, a magnetic disk substrates and the like or the inspecting process of an electronic component, and for fixing them at prescribed positions.

[0003]

For example, regarding a supporting table to be employed for transferring a circuit to a wafer such as a semiconductor wafer and a glass substrate or for carrying out exposure treatment, there has been available a vacuum chuck type one, as shown in Fig. 5, comprising a disk-like substrate 111 and a large number of suction holes 113 formed in a supporting face 112 of said substrate 111.

[0004]

Further, with respect to a transportation arm for transporting a wafer such as a semiconductor wafer, a glass substrate and the like, there have been available a suction type one of plate-like body 121 which has a supporting face 122 in the tip part as shown in Fig. 6 and is provided with a suction port 123 in the center part of said supporting face 122 and a through hole 124 interconnected with said suction port 123 inside and another holding type which comprises a simply plate-like body 131 as shown in Fig. 7 and is provided with a recessed part fitted with the shape of a wafer in one surface to make the bottom face of the recessed part be a supporting face 132.

[0005]

Further, with respect to a vacuum chuck to be used at the time of forming a thin film on a wafer such as a semiconductor wafer, a liquid crystal substrate and the like, there has been available one which comprises a disk-like substrate 141 having the upper face as a supporting face 142 as shown in Fig. 8, electrostatic electrodes 143 embedded inside, and lead terminals 144 for electricity communication to the electrostatic electrodes 143 in the down face of the substrate 141.

[0006]

Further, such object supporting device of this type such as supporting table 100, transportation arms 120, 130, or vacuum chuck 140 are required to be finished so as to have supporting face 112, 122, 132 and 142 with high flatness precision and avoid

forming scratches in a wafer and especially, in the case the object is a semiconductor wafer, pollution has to be prevented, so that there have been apparatus of which at least the supporting faces 112, 122, 132 and 142 made of a high purity alumina ceramic, silicon carbide-based ceramic, or further aluminum nitride-based ceramic (see Japanese Utility Model Application Laid-Open No. 62-72062 and Japanese Patent Application Laid-Open No. 53-96762).

[0007]

Further, with respect to supporting table 100 to be used in the exposure treatment of a glass substrate, there is one comprising a substrate 111 made of a metal and coated with black resin in the surface thereof in order to prevent reflection of light transmitted through the glass substrate by the surface of the supporting table 100 at the time of exposure (see Japanese Patent Application Laid-Open No. 4-323670).

[0008]

[Problems to be Solved by the Invention]

However, these object supporting devices have the following problems.

[0009]

At first, in an object supporting device having supporting faces 112, 122, 132 and 142 made of ceramics such as an alumina ceramic, a silicon carbide-based ceramic, or an aluminum nitride-based ceramic, although the ceramics are highly hard

materials, the hardness is approximately even at highest 2500 kg/mm^2 Vickers hardness, so that there are problems that the wear of the supporting faces 112, 122, 132 and 142 by sliding attributed to attachment and detachment of objects cannot be sufficiently prevented and that the flatness precision of the supporting faces 112, 122, 132 and 142 is deteriorated. Moreover, since a large number of ultra small voids exist in the supporting face 112, 122 and 132, dust is easily accumulated in the voids and when objects are mounted on such supporting faces 112, 122, 132 and 142, the dust adheres to the objects to result in deterioration of the flatness precision of the objects.

[0010]

Therefore, in the case the object supporting device are transportation arms 120 and 130, they have to be replaced with new ones within a relatively short time and in the case the object supporting device is a supporting table 100, disconnection and short circuit take place at the time of transferring circuits of objects and defective resolution takes place at the time of exposure and in the case, the object supporting device is an electrostatic chuck 140, the film thickness is dispersed and uniform films cannot be formed on objects.

[0011]

On the other hand, in the case of a supporting table 100 comprising a substrate 111 made of a metal and coated with black resin on the surface, the resin applied to the surface of the

substrate 111 is worn out within a short time due to attachment and detachment of glass substrates and also, since the substrate 111 is made of a metal, high flatness precision of the supporting face 112 is hard to obtain and further since the thermal expansion coefficient of the substrate 111 is too high compared with that of the glass substrate, the flatness precision of the glass substrate is decreased by the heat accumulated in the substrate 111 at the time of exposure to result in defective resolution.

[0012]

Further, such kind of a supporting table 100 is to be used while being installed on an X-Y table and therefore, with respect to the supporting table 100 comprising the substrate 111 made of a metal, there is a problem that the specific gravity is so high that high speed transportation is impossible.

[0013]

[Means for Solving the Problems]

In view of the above-described problems, an object supporting device according to the present invention has a supporting face made of a ceramic on which an object, e. g., a wafer such as a semiconductor wafer and a glass substrate for LCD, a magnetic disk substrate, an electronic component and the like is supported by suction or mounting, and the supporting face is covered with an amorphous hard carbon film.

[0014]

In the present invention, the amorphous hard carbon film

has a film thickness of 0.2 to 10 μm.

[0015]

[Embodiments of the Invention]

That is, the present invention is an object supporting device of which the supporting face is coated with an amorphous hard carbon film having a higher hardness than a ceramic which is in a range of 3000 to 5000 kg/mm^2 Vickers hardness (Hv). Therefore, even if attachment and detachment of objects are repeated, the supporting face is scarcely worn out and the life of the object supporting device can be prolonged.

[0016]

Moreover, since voids scarcely exist in the surface of the amorphous hard carbon film, the dust adhesion can be considerably suppressed to result in no flatness precision deterioration of a wafer.

[0017]

Further, the amorphous hard carbon film scarcely contains impurities and basically made of only carbon and accordingly, even if an object is a semiconductor wafer, only a few bad effects are caused.

[0018]

Further, since the amorphous hard carbon film has black color unlike diamond, light reflection can be significantly suppressed. Accordingly, the amorphous hard carbon film can be preferably used for the supporting face of a supporting table

to be employed for the exposure treatment of a glass substrate.

[0019]

It is noted that the term "amorphous hard carbon film" in this invention means a carbon film synonymously called as a synthetic pseudo-diamond thin film, a DLC film, a diamond-like carbon film, an I-carbon film and its structure observed by a transmission electron microscope (TEM) is extremely dense and has no grain boundary and amorphous structure in the form like broken glass. Incidentally, the structure may include an amorphous structure slightly containing crystalline phase.

[0020]

Further, the film has a peak around 1333 cm^{-2}, a position of a peak of diamond and a peak around 1550 cm^{-2}, a position of a peak of graphite, by analysis using a Raman scattering spectroscopic apparatus to be employed for identification of graphite or diamond and the peaks may be deflected toward either peak of diamond or graphite.

[0021]

Nevertheless, the film thickness of the amorphous hard carbon film to coat the supporting face of an object supporting device is preferably in a range of 0.2 to 10 μm.

[0022]

Here, the reason for the limitation of the film thickness of the amorphous hard carbon film in the range of 0.2 to 10 μm is because if the film thickness is less than 0.2 μm, even the

amorphous hard carbon film having a high hardness is worn within a short time due to attachment and detachment of objects. Moreover, in the case the object supporting device is a supporting table to be used for exposure treatment of a glass substrate, there is a problem that the light reflection by the supporting face becomes significant. Further, on the contrary, it is because if the film thickness is thicker than 10 μm, the film surface becomes impossible to keep a prescribed precision of face flatness and the film is easy to be peeled. On the other hand, in the present invention, it is important to form at least the supporting face of the object supporting device by using a ceramic and as the ceramic to be employed is preferably an alumina ceramic, a zirconia ceramic, a silicon carbide-based ceramic, a silicon nitride-based ceramic, an aluminum nitride-based ceramic, an alumina-titanium carbide-based ceramic and the like.

[0023]

That is, as shown in Table 1, since these ceramics have a high specific rigidity of not less than 3×10^5 cm, they are hardly deformed and further since they have a high hardness of 1100 to 2400 kg/mm^2 Vickers hardness, if the object supporting device is a transportation arm, they scarcely sag at the time of transportation of an object and are capable of transporting an object accurately to a prescribed position without dropping it and similarly, if the object supporting device is a supporting

table or an electrostatic chuck, since the supporting face can be finished to have smooth and excellent flatness precision, the flatness precision of the object can be increased and precise fixation is made possible. Moreover, the object supporting device can be made lightweight, in the case the object supporting device is a supporting table, it can be mounted on an X-Y table and moved at a high speed and therefore, it is most optimum.

[0024]

Further, the above-mentioned ceramics have a small thermal expansion coefficient of not more than $1 \times 10^{-5}/°C$ and similar to the thermal expansion coefficient of an object such as a semiconductor wafer and a glass substrate for LCD, so that if the object supporting device is a supporting table or an electrostatic chuck to be used for exposure or film formation, even if heat generated by the exposure and the film formation is accumulated in the supporting table or the electrostatic chuck, no significant size alteration is caused in the object such as the semiconductor wafer and the glass substrate for LCD.

[0025]

[Table 1]

Material	Specific rigidity ($\times 10^5$ cm)	Vickers hardness (kg/mm^2)	Thermal expansion coefficient ($\times 10^{-5}°C$)
Al_2O_3	0.8 to 1.0	1600 to 1850	6.5 to 7.8
ZrO_2	0.35 to 0.5	1250 to 1950	10.0 to 11.5
SiC	1.26 to 1.4	2400	3.5 to 4.5
Si_3N_4	0.9 to 1.0	1450 to 1500	2.5 to 3.0
AlN	0.9 to 1.0	1100	4.0 to 5.5

Al_2O_3-TiC	0.9 to 1.0	1900 to 2100	7.3 to 8.0

[0026]

It is noted that, in the case of obtaining these ceramics, for example, in the case of an alumina ceramic, Al_2O_3 is used as a main raw material and at least one of CaO, SiO_2 and MgO is added as a sintering aid and firing is carried out at a temperature about 1400 to 1800°C and in the case of silicon nitride, Si_3N_4 is used as a main raw material and at least one of oxides and nitrides of Group IIA and IIIA elements in a periodic table is added as a sintering aid and firing is carried out at a temperature about 1850 to 2000°C. Also, in the case of silicon carbide, SiC is used as a main raw material and at least one of C, B, B_4, C, Al_2O_3, Y_2O_3 and the like is added as a sintering aid and firing is carried out at a temperature about 1850 to 2000°C and in the case of zirconia, ZrO_2 is used as a main raw material and at least one of Y_2O_3, CaO, MgO, CeO_2 and the like is added as a sintering aid and firing is carried out at a temperature about 1500 to 1700°C. Further, in the case of an aluminum nitride ceramic, AlN is used as a main raw material and at least one of Er_2O_3, Y_2O_3, Yb_2O_3 and the like is added as a sintering aid and firing is carried out at a temperature about 1700 to 1900°C and in the case of an alumina-titanium carbide-based ceramic, Al_2O_3 and TiC are mixed at a prescribed amount as main raw materials and at least one of TiO_2, MgO, SiO_2 and Y_2O_3 is added as a sintering aid and firing is carried out

at a temperature about 1600 to 1800°C and accordingly, ceramics excellent in strength, rigidity, and wear resistance can be obtained.

[0027]

Further, the supporting face of an object supporting device coated with an amorphous hard carbon film is preferable to have an average roughness relative to the average line (Ra) of not more than 0.4 μm. That is because if the average roughness relative to the average line (Ra) is higher than 0.4 μm, the film surface becomes too coarse even if an amorphous hard carbon film with a film thickness of 0.2 to 10 μm is formed thereon to result in deterioration of flatness precision of the supporting face and at the same time result in probability of scratch formation on the wafer surface in the case an object is a wafer such as semiconductor wafer, a glass substrate or the like.

[0028]

It is noted that, as means for film formation of an amorphous hard carbon film on the supporting face of an object supporting device, in order to suppress the deterioration of the flatness precision by heat, it is preferable to employ a thin film formation means, such as a PVD method, an ion plating method and the like, which are capable of forming a film at a low temperature. For example, to explain the PVD method, an object supporting device is set on a cathode board installed in a chamber and a hydrocarbon

(C_6H_6) gas is introduced into a chamber. Then, voltage is applied to a filament installed in the cathode gun to thermally decompose the hydrocarbon gas to generate radical carbon ion and after that, voltage is applied between both electrodes of an anode board and the cathode board, the carbon ion springs out of the cathode gun and is deposited and accumulated on the surface of the object supporting device installed on the cathode board to form a film of an amorphous hard carbon film.

[0029]

[Examples]

Hereinafter, examples of the present invention will be described.

[0030]

(Example 1)

Figs. 1(a) and 1(b) illustrate a supporting table 10 which is one example of an object supporting device according to the present invention, and Fig. 1(a) is a plan view and Fig. 1(b) is a cross sectional view taken along the X-X line of the plan view.

[0031]

The supporting table 10 comprises a substrate 11 which is a disk plate made of an alumina ceramic with a purity of 99.9% and ring-like pins 16 are stuck concentrically into one surface of the substrate and the surface of the ring-like pins 16 is made to be a supporting face 12. Further, a large number of

suction holes 13 are formed in the surface of the substrate 11 in the supporting face 12 side and lead-out holes 14 interconnected with the suction holes 13 are formed in a side wall face of the substrate 11. Further, the surface of the substrate 11 including the supporting face 12 is coated with an amorphous hard carbon film 15 with a film thickness of 0.2 to 10 μm.

[0032]

A wafer such as a semiconductor wafer, a glass substrate and the like as an object is disposed on the supporting face 12 and vacuum suction through the lead-out holes 14 is carried out, so that the space surrounded with the rear face of the wafer and the ring-like pins 16 can be kept in negative pressure and the wafer can be fixed while the flatness precision of the supporting face being corrected. At that time, since the thin amorphous hard carbon film 15 is formed on the supporting face 12 of the supporting table 10, the film surface scarcely has voids and therefore dust adhesion can be prevented as well as the supporting face is scarcely worn out even if attachment and detachment of wafers are repeated. Moreover, since the substrate 11 is made of an alumina ceramic with a specific rigidity of not less than 0.9×10^9 cm, the supporting face can be finished to be smooth and excellent in flatness precision.

[0033]

Accordingly, if a wafer is fixed using the supporting table

10, the wafer can be fixed accurately without scratching the wafer, and particularly, even if the wafer is a semiconductor wafer, the wafer is not affected with any bad effect.

[0034]

Further, in the case a circuit is transferred to a semiconductor wafer using the supporting table 10, the circuit can be formed without being accompanied with disconnection or short circuit and in the case exposure treatment is carried out for the semiconductor wafer, the exposure treatment can be carried out excellently without causing defective resolution.

[0035]

Further, at the time of carrying out exposure treatment of a glass substrate using the above-mentioned supporting table 10, the light transmitted through the glass substrate is absorbed in the surface of the substrate 11 in the supporting face 12 side to remarkably decreased the reflection and therefore, the exposure treatment can be carried out excellently.

(Example 2)

Figs. 2(a) and 2(b) illustrate a transportation arm 20 which is another example of an object supporting device according to the present invention, and Fig. 2(a) is a plan view and Fig. 2(b) is a cross sectional view taken along the Y-Y line of the plan view.

[0036]

The transportation arm 20 comprises a supporting face 22

in the tip part of a plate-like body 21 made of an alumina ceramic with a purity of 99.9% and suction holes 23 are formed in the supporting face 22 for vacuum sucking a wafer and through holes 24 interconnected with the suction holes 23 are formed inside of the plate-like body 21.

[0037]

Further, the surface of the supporting table 21 including the supporting face 22 is coated with an amorphous hard carbon film 25 with a film thickness of 0.2 to 10 μm.

[0038]

A wafer is disposed on the supporting face 22 and vacuum suction through the through holes 24 is carried out, so that the wafer can be transported while being sucked and fixed on the supporting face 22 through the through holes 24. At that time, since the thin amorphous hard carbon film 25 is formed on the supporting face 22 of the transportation arm 20, the film surface scarcely has voids and therefore dust adhesion can be prevented and the supporting face is scarcely worn out even if attachment and detachment of wafers are repeated. Moreover, since the film surface can be finished to be smooth and excellent in flatness precision, wafers are not affected with any bad effect at the time of attachment and detachment of the wafers.

[0039]

Further, since the above-mentioned amorphous hard carbon film 25 is a carbon film basically free from impurities, even

if an object is a semiconductor wafer, no bad effect is caused.

[0040]

(Example 3)

Figs. 3(a) and 3(b) illustrate a transportation arm 30 which is another example of an object supporting device according to the present invention, and Fig. 3(a) is a plan view and Fig. 3(b) is a cross sectional view taken along the Z-Z line of the plan view.

[0041]

The transportation arm 30 comprises a plate-like body 31 having a recessed part fitted with the shape of a semiconductor wafer, an object, in one surface and a supporting face 32 formed in the bottom face of the above-mentioned recessed part. Further, the surface of the plate-like body 31 including the supporting face 32 is coated with an amorphous hard carbon film 35 with a film thickness of 0.2 to 10 μm.

[0042]

A wafer is fitted in the recessed part of the above-mentioned plate-like body 31 and transported while being held on the supporting face 32. At that time, since the semiconductor wafer is perfectly held in the recessed part of the plate-like body 31, it is prevented from displacement or dropping.

[0043]

Further, since the thin amorphous hard carbon film 35 is

formed on the supporting face 32 of the transportation arm 30, similarly to the case of the transportation arm 20 illustrated in Figs. 2(a) and 2(b), the film surface scarcely has voids and therefore dust adhesion can be prevented and the supporting face is scarcely worn out even if attachment and detachment of wafers are repeated. Moreover, since the film surface can be finished to be smooth and excellent in flatness precision, wafers are not affected with any bad effect at the time of attachment and detachment of the wafers. Further, since the above-mentioned amorphous hard carbon film 25 is a carbon film basically free from impurities, no bad effect is caused on a semiconductor wafer held thereon.

[0044]

(Example 4)

Figs. 4(a) and 4(b) illustrate an electrostatic chuck 40 which is another example of an object supporting device according to the present invention, and Fig. 4(a) is a plan view and Fig. 4(b) is a cross sectional view taken along the P-P line of the plan view.

[0045]

The electrostatic chuck 40 comprises a disk-like substrate 41 having an upper face as a supporting face 42 and made of an aluminum nitride-based ceramic, electrostatic electrodes 43 embedded inside of the substrate 41, and lead terminals 44 made of a metal such as tungsten, molybdenum and the like and soldered

in the down face of the substrate 41 to be interconnected with the electrostatic electrodes 43. Further, the surface of the substrate 41 including the supporting face 42 is coated with an amorphous hard carbon film 45 with a film thickness of 0.2 to 10 μm.

[0046]

A semiconductor wafer, as an object, is mounted on the supporting face 42 and voltage is applied to the semiconductor wafer and the electrostatic electrodes 43 to generate Coulomb force due to induced polarization and Johnson-Larbech force due to slight current leakage to suck and fix the semiconductor wafer on the supporting face 42.

[0047]

At that time, since the thin amorphous hard carbon film 45 is formed on the supporting face 42, the film surface scarcely has voids and therefore dust adhesion can be prevented and the supporting face is scarcely worn out even if attachment and detachment of wafers are repeated. Moreover, since the substrate 41 is made of the aluminum nitride-based ceramic with a specific rigidity of not less than 0.9×10^9 cm, the supporting face 42 can be finished to be smooth and excellent in flatness precision. Accordingly, in the case the semiconductor wafer is fixed by using the electrostatic chuck 40, the wafer can be accurately fixed without being scratched and since no particle adhesion takes place, no bad effect is caused on the semiconductor

wafer held and a film with an even thickness can be formed on the semiconductor wafer.

[0048]

It is noted that, in Example 4, an electrostatic chuck 40 as an object supporting device to be employed for film formation is described, the application is also possible to a susceptor for mounting and holding thereon. Further, in the above-mentioned examples, object supporting device for holding a wafer such as a semiconductor wafer, a glass substrate and the like are mainly described, however it is no need to say that they can be employed for transporting or fixing objects such as a magnetic disk substrate, electronic parts and the like.

[0049]

(Experiment Example 1)

Here, a ball-on-disk test was carried out in order to investigate wear resistance of a ceramic plate coated with an amorphous hard carbon film.

[0050]

The measurement was carried out under a condition that a ball was pushed with a load of 0.5 kg to a sample made of an alumina ceramic plate coated with an amorphous hard carbon film of the examples according to the present invention and the sample was rotated at 0.17 m/s speed for 10 hours and then the wear degree of the sample was measured. On the other hand, as Comparative Example, plates respectively made of an alumina

ceramic with 99.9% purity, a hard metal, a silicon carbide ceramic, and an alumina ceramic coated with a titanium nitride film were made ready and subjected similarly to the experiment.

[0051]

The results for the respective samples are as shown in Table 2.

[0052]

[Table 2]

	Sample (Material)	wear degree of sample ($\times 10^{-3}$ $mm^3/kg/km$)
Present invention	Amorphous hard carbon film (Base material: Al_2O_3)	2
Comparative example	TiN film (Base material: Al_2O_3)	3.2
	Al_2O_3	4
	WC	8
	SiC	8

[0053]

As being understood from the results, the wear degree of the sample of the present invention could be suppressed most to 2×10^{-3} $mm^3/kg/km$.

[0054]

Accordingly, it can be understood that in the case an object supporting device according to the present invention is used for transporting and fixing an object, wear due to attachment and detachment of objects can be considerably suppressed and the life of the object supporting device can be prolonged.

[0055]

(Experiment Example 2)

Next, as an object supporting device of the present invention, a supporting table 10 comprising a substrate 11 made of an alumina ceramic and an amorphous hard carbon film 15 formed on the surface of the substrate was made on an experimental basis and subjected to attachment and detachment of a semiconductor wafer repeated 50000 times and then the number of particles adhering to the semiconductor wafer was counted by a particle counter.

[0056]

It is noted that, as Comparative Example, a supporting table 10 comprising a substrate 11 made of an alumina ceramic having 99.9% purity and a titanium nitride film formed on the surface of the substrate 11 was made on an experimental basis and subjected to the similar measurement.

[0057]

The results for the respective samples are as shown in Table 3.

[0058]

[Table 3]

	Sample (Material)	Number of particles
Present invention	Amorphous hard carbon film (Base material: Al_2O_3)	1
Comparative example	TiN film (Base material: Al_2O_3)	2
	Al_2O_3	10

[0059]

From the results, it was found that the number of adhering particles could be most suppressed in the case the supporting table 10 according to the present invention was employed.

[0060]

From that, it can be understood that the object supporting device according to the present invention was most optimum to hold a semiconductor wafer.

[0061]

(Experiment Example 3)

Further, light with wavelength of 400 nm and light with wavelength of 800 nm to be employed for exposure were respectively radiated to a supporting table 10 similar to that of Experiment Example 2 as an object supporting device according to the present invention and the reflectivity for each was measured.

[0062]

As Comparative Example, supporting tables 10 made of a silicon carbide-based ceramic and a silicon nitride-based ceramic and a supporting table comprising a substrate 11 made of a metal and coated with ABS resin were respectively made ready and subjected to the similar measurement.

[0063]

The results for the respective samples are as shown in Table 4.

[0064]

[Table 4]

	Sample (Material)	Reflectivity (%)	
		400 nm	800 nm
Present invention	Amorphous hard carbon film (Base material: Al_2O_3)	15	15
Comparative example	ASB resin film (Base material: metal)	16	16
	Silicon carbide	18	20
	Silicon nitride	23	22

[0065]

As being understood from Table 4, although having black color, the supporting tables of the Comparative Examples made of the silicon carbide-based ceramic and the silicon nitride-based ceramic were found having about 20% reflectivity and being incapable of efficiently absorbing light with either wavelength.

[0066]

Further, although the supporting table 10 comprising the substrate 11 made of a metal and coated with the ABS resin was found having considerably suppressed reflectivity, around 16%, for the light with both wavelength values, the surface was made of the resin with a low hardness and therefore, wear took place within a short time due to the attachment and detachment of a wafer.

[0067]

On the other hand, in the case of the supporting table 10 of the present invention coated with the amorphous hard carbon

film, the supporting table could suppress the reflectivity to 15% for the light with wavelength of 400 nm and the light with wavelength of 800 nm and was found most excellent. Moreover, since the amorphous hard carbon film 15 with a high hardness was formed on the supporting face 12, no wear was observed in attachment and detachment of a wafer.

[0068]

Accordingly, it can be understood that if an object supporting device according to the present invention coated with the amorphous hard carbon film on the supporting face is used as the supporting table 10 for exposure treatment of a glass substrate, reflection of the light transmitted through the glass substrate can be suppressed and exposure treatment free from defective resolution can be carried out excellently.

[0069]

[Effects of the Invention]

As described above, according to the present invention, in an object supporting device comprising a supporting face made of a ceramic for sucking or mounting an object thereon, coating of the above-mentioned supporting face with an amorphous hard carbon film makes it possible to considerably suppress the wear of the supporting face due to sliding between an object and the supporting face and also, since the supporting face scarcely has voids, dust adhesion can be suppressed remarkably. Moreover, since the amorphous hard carbon film is a carbon film scarcely

containing impurities, no bad effect is caused on an object, even if a semiconductor wafer is the object. Accordingly, in the case the object supporting device is a transportation arm, the number of times of replacement due to the wear of the supporting face can be considerably decreased and also, in the case the object supporting device is a supporting table, disconnection and short circuit can be suppressed at the time of transferring a circuit and moreover, defective resolution at the time of exposure can be avoided. Furthermore, in the case the object supporting device is an electrostatic chuck, an even film can be formed on an object.

[0070]

Further, since the amorphous hard carbon film formed on the supporting face has black color, the light reflection can be considerably suppressed at the time of exposure of a glass substrate and therefore, no defective resolution takes place and exposure treatment can be carried out excellently.

[Brief Description of the Drawings]

Figs. 1(a) and 1(b) illustrate a supporting table which is one example of an object supporting device according to the present invention, and specifically, Fig. 1(a) is a plan view and Fig. 1(b) is a cross sectional view taken along X-X line of Fig. 1(a).

Figs. 2(a) and 2(b) illustrate a transportation arm which is one example of the object supporting device according to the

present invention, and specifically, Fig. 2(a) is a plan view and Fig. 2(b) is a cross sectional view taken along Y-Y line of Fig. 2(a).

Figs. 3(a) and 3(b) illustrate a transportation arm which is another example of the object supporting device according to the present invention, and specifically, Fig. 3(a) is a plan view and Fig. 3(b) is a cross sectional view taken along Z-Z line of Fig. 3(a).

Figs. 4(a) and 4(b) illustrate an electrostatic chuck which is one example of the object supporting device according to the present invention, and specifically, Fig. 4(a) is a plan view and Fig. 4(b) is a cross sectional view taken along P-P line of Fig. 4(a).

Fig. 5 is a perspective view showing a conventional supporting table.

Fig. 6 is a perspective view showing a conventional suction type transportation arm.

Fig. 7 is a perspective view showing a conventional supporting type transportation arm.

Fig. 8 is a perspective view showing a conventional electrostatic chuck.

[Description of Reference Numerals]

10: supporting table

11: substrate

12: supporting face

13: suction port

14: lead-out hole

[Written amendment]

[Date of submission] December 20, 1995

[Amendment 1]

[Title of object document for amendment] Drawing

[Title of object item for amendment] Fig. 4

[Method for amendment] conversion

[Content of amendment] [Fig. 4]